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TITLE: GRADATION CORRECTING CIRCUIT FOR LIQUID CRYSTAL VIDEO DISPLAY DEVICE

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ASSIGNEE-INFORMATION:

NAME	COUNTRY
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ABSTRACT:

PURPOSE: To easily attain a gradation correction by reducing the deterioration of a color reproducibility.

CONSTITUTION: Video signals, B, G, and R are respectively clamped into the same voltage by clamp circuits 1B, 1G, and 1R. A reference signal is inserted into one line in a vertical fly-back period in the clamped video signal R. Then, an average luminance detecting and expanding level control circuit 5 detects a luminance signal from the clamped video signals B, G, and R, outputs a control signal SL for controlling an expanding level by the detected average luminance, inputs it to an expanding circuit 3R, and the gradation correction of the video signals B, G, and R is operated according to the average luminance by expanding circuits 3B, 3G, and 3R. An amplitude control circuit 6 detects the reference signal inserted into a video signal R<SB>0</SB>, controls amplitude adjusting

PATENT ABSTRACTS OF JAPAN

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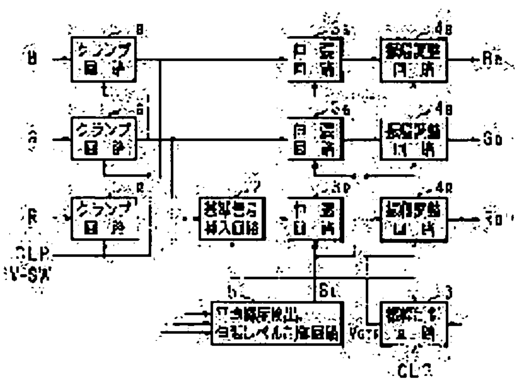
(54) GRADATION CORRECTING CIRCUIT FOR LIQUID CRYSTAL VIDEO DISPLAY DEVICE

(57)Abstract:

PURPOSE: To easily attain a gradation correction by reducing the deterioration of a color reproducibility.

CONSTITUTION: Video signals, B, G, and R are respectively clamped into the same voltage by clamp circuits 1B, 1G, and 1R. A reference signal is inserted into one line in a vertical fly-back period in the clamped video signal R. Then, an average luminance detecting and expanding level control circuit 5 detects a luminance signal from the clamped video signals B, G, and R, outputs a control signal SL for controlling an expanding level by the detected average luminance, inputs it to an expanding circuit 3R, and the gradation correction of the video signals B, G, and R is operated according to the average luminance by expanding circuits 3B, 3G, and 3R. An amplitude control circuit 6 detects the reference signal inserted into a video signal R0, controls amplitude adjusting circuits 4B, 4G, and 4R, so that the amplitude gradation-corrected video signals B0, G0, and R0 can be always constant.



CLAIMS

[Claim(s)]
[Claim 1] Have the following, and control the 1st, the 2nd, and 3rd extension circuit by the aforementioned control signal in common, and the average luminance of a video signal expands a low case to a black side with it. It is the gradation amendment circuit of the liquid crystal display unit which displays an image using liquid crystal which performs the gradation amendment expanded to a white side when average luminance is high, and is characterized by constituting that the amplitude of the video signal which the 1st, the 2nd, and 3rd extension circuit outputted by the amplitude-control circuit should be controlled in common. The reference signal insertion circuit which the voltage which clamped the pedestal of one video signal in three primary colors on predetermined voltage is inputted, and inserts a predetermined reference signal within the vertical-retrace-line period of a video signal. the voltage which clamped the pedestal of the video signal of the two remaining primary colors on predetermined voltage -- each -- **** -- the 1st inputted and 2nd extension circuit The 3rd extension circuit where the video signal which the aforementioned reference signal insertion circuit outputs is inputted. The amplitude-control circuit which the voltage which carried out [aforementioned] the clamp is inputted, and the video signal based on the video signal which the average-luminance detection and the extension level control circuit which output the control signal which detects the average luminance of a video signal and controls extension level, and the aforementioned extension circuit output is inputted, and controls the amplitude of the video signal outputted from the 1st, the 2nd, and 3rd extension circuit.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the gradation amendment circuit of liquid crystal display units, such as a liquid crystal video display and a liquid crystal video projector.
[0002]
[Description of the Prior Art] Generally a liquid crystal video display is CRT. The dynamic range which expresses between the black side of an image and white sides as compared with a display is narrow, and the gradation in dark space and a bright section breaks. In order to improve this, a gradation amendment of fixation is performed conventionally, or it is the average luminance (APL) of a video signal. It corresponds and is a luminance signal. (Y signal) It receives and the gradation amendment is performed. moreover, the amendment by the side of the black of a video signal and the amendment by the side of white -- each -- **** -- it is carrying out
[0003]
[Problem(s) to be Solved by the Invention] Thus, although a circuit ends in one circuit when performing a gradation amendment to a luminance signal, since a gradation amendment cannot be performed to a chroma signal, the saturation ratio of the color of the reproduced image changes and the repeatability of a color becomes bad. Therefore, it is not suitable for the Hi-Vision display which thinks the repeatability of an image as important by high definition. Moreover, since the repeatability of the color of the portion rectified when dispersion arose in the gradation amendment property of each video signal in three primary colors becomes bad when performing a gradation amendment to the three primary colors, it is necessary to make a gradation amendment property completely in agreement [a video signal in three primary colors]. Therefore, conventionally, in order that the part which must adjust the gradation amendment property of a video signal in three primary colors separately, and should adjust it may double the property of performing many [therefore] gradation amendments in three primary colors, there is a problem that complicated adjustment operation is required in a gradation amendment case.
[0004] this invention aims at offering the gradation amendment circuit of the liquid crystal display unit which can perform a gradation amendment by easy adjustment in view of this problem, without degrading the repeatability of a color.
[0005]
[Means for Solving the Problem] The gradation amendment circuit of the liquid crystal display unit concerning this invention In the gradation amendment circuit of the liquid crystal display unit which displays an image using liquid crystal The reference signal insertion circuit which the voltage which clamped the pedestal of one video signal in three primary colors on predetermined voltage is inputted, and inserts a predetermined reference signal within the vertical-retrace-line period of a video signal, the voltage which clamped the pedestal of the video signal of the two remaining primary colors on predetermined voltage -- each -- **** -- with the 1st inputted and 2nd extension circuit The 3rd extension circuit where the video signal which the aforementioned reference signal insertion circuit outputs is inputted, The average-luminance detection and the extension level control circuit which output the control signal which the voltage which carried out [aforementioned] the clamp is inputted, detects the average luminance of a video signal, and controls extension level, The video signal based on the video signal which the aforementioned extension circuit outputs is inputted, and it has the amplitude-control circuit which controls the amplitude of the video signal outputted from the 1st, the 2nd, and 3rd extension circuit. with the aforementioned control signal Control the 1st, the 2nd, and 3rd extension circuit in common, and the average luminance of a video signal expands a low case to a black side. When average luminance is high, the gradation amendment expanded to a white side is performed, and it is characterized by constituting that the amplitude of the video signal which the 1st, the 2nd, and 3rd extension circuit outputted by the amplitude-control circuit should be controlled in common.
[0006]
[Function] the voltage which clamped the pedestal of two video signals in three primary colors -- the 1st

and 2nd extension circuit -- each -- **** -- it inputs A reference signal is inserted in the voltage which clamped the pedestal of the one remaining video signal within a vertical-retrace-line period, and it inputs into the 3rd extension circuit. It is a gradation amendment in common about the video signal inputted into each extension circuit so that the voltage which clamped each pedestal of a video signal in three primary colors detects average luminance, the control signal which controls extension level by the average luminance was created, and it gave to each extension circuit, and a low case elongates a black side, and average luminance might elongate a white side, when average luminance was high. It controls by the video signal based on each video signal which each extension circuit outputted in common to make the amplitude of the video signal which each extension circuit outputted to a predetermined value. Thereby, it sees according to average luminance and the upper dynamic range can be expanded. Moreover, the property of a gradation amendment of each video signal in three primary colors may be made in agreement.

[0007]

[Example] this invention is explained in full detail below with the drawing in which the example is shown. Drawing 1 is the block diagram showing the composition of the gradation amendment circuit of the liquid crystal display unit concerning this invention. The video signals B, G, and R in three primary colors are clamping circuit 1B, 1G, and 1R. It is inputted. clamping circuit 1B, 1G, and 1R **** -- clamp pulse CLP which defines the timing which clamps a pedestal It is given. Clamping circuit 1B and 1G The clamped voltage slack video signal is extension circuit 3B and 3G. The video signal which it is inputted and extension circuit 3B and 3G output is amplitude equalization circuit 4B and 4G. It is inputted. The video signal which the voltage which clamping circuit 1R clamped is inputted into the reference signal insertion circuit 2, and the reference signal insertion circuit 2 outputs is extension circuit 3R. It is inputted. Extension circuit 3R The video signal to output is amplitude equalization circuit 4R. It is inputted.

[0008] Change signal V-SW for defining the timing which inserts the reference signal equivalent to 100IRE(s) is inputted into the reference signal insertion circuit 2 and the amplitude-control circuit 6. Clamping circuits 1B and 1G and 1R Both the voltage that each clamped is the control signals SL which control the extension level created by the average luminance which it was inputted into average-luminance detection and the extension level control circuit 5, and was detected. Extension circuit 3B, 3G, and 3R It is given. Control signal SCTR which the amplitude-control circuit 6 outputs Amplitude equalization circuit 4B, 4G, and 4R It is given. Amplitude equalization circuit 4B, 4G, and 4R The chrominance signal B0 which performed the shell gradation amendment, G0, and R0 It is outputted and is a chrominance signal R0. It is inputted into the amplitude-control circuit 6. A clamp pulse CLP is given to the amplitude-control circuit 6.

[0009] Drawing 2 is extension circuit 3R. It is the circuit diagram showing composition, and is extension circuit 3B and 3G. It is constituted similarly. Signal input terminal 3a is the transistor TR1 of a grounded collector. Connecting with the base, the emitter is a transistor TR2. It connects with the base and connects with power-terminal +B1 through resistance R0. Power-terminal +B1 is a capacitor. (not shown) It minds and is grounded in alternating current. Transistor TR2 It is grounded through resistance R2, resistance R3 is minded, and an emitter is a transistor TR3. Resistance R4 is minded and it is [an emitter and] the transistor TR4 of a grounded collector. It connects with an emitter. Transistor TR2 It connects with power-terminal +B1 through resistance R1, resistance R5 is minded, and a collector is a transistor TR5. It connects with the base.

[0010] Transistor TR3 A collector is connected with power-terminal +B1, and the base is grounded through resistance R6, and is connected with power-terminal +B-2 through the series circuit of resistance R7, R8, and R9. The connection with resistance R8 and R9 is a transistor TR4. It connects with the base. The connection with resistance R7 and R8 is connected with control-voltage input terminal 3b into which the extension level control voltage from average-luminance detection and the extension level control circuit 5 is inputted. Transistor TR5 The emitter is connected with signal output terminal 3c which outputs the video signal by which the gradation amendment was carried out by connecting a collector with power-terminal +B1, and it is resistance R10. It is minded and grounded.

[0011] Drawing 3 is the block diagram showing the composition of the amplitude-control circuit 6. The amplitude-control circuit 6 is constituted by clamp section 6a, sample, and hold section 6b and error detecting-element 6c. Video signal R0 which amplitude equalization circuit 4R (refer to drawing 1) outputs to clamp section 6a and by which the gradation amendment was carried out It is inputted and is a clamp pulse CLP. It is given. The video signal which clamp section 6a outputs is inputted into sample and hold section 6b. Change signal V-SW is given to sample and hold section 6b. A sample and the signal which hold section 6b outputs are inputted into error detecting-element 6c, and error detecting-element 6c is amplitude equalization circuit 4R. The control signal SCTR to give is outputted.
[0012] Next, operation of the gradation amendment circuit of the liquid crystal display unit constituted in this way is explained. In addition, video signals R, G, and B explain a video signal R, in order for a gradation amendment to be similarly performed by each. Clamping circuit 1R If a video signal R is inputted, it is clamping circuit 1R. It is a clamp pulse CLP about the inputted pedestal of a video signal R. It clamps to timing, the clamped voltage is outputted, and it inputs into the reference signal insertion circuit 2. In addition, it is made for dispersion in a clamp voltage not to produce clamp reference voltage between video signals R and G and B using the same power supply as each of video signals R, G, and B.

luminance detector

[0013] Clamping circuit 1R If the clamp voltage to output is inputted into the reference signal insertion circuit 2, the reference signal insertion circuit 2 will insert the reference signal which is equivalent to 100IRE(s) with change signal V-SW into vertical-retrace-line period 1H of a video signal R, as shown in drawing 4 . On the other hand, it is clamping circuit 1R. The clamp voltage of a shell is inputted into average-luminance detection and the extension level control circuit 5, and average-luminance detection and the extension level control circuit 5 create a luminance signal (Y signal) in the matrix circuit which obtains a luminance signal with the video signal of a video signal R in three primary colors, and detect average luminance by the integrating circuit which consists of a capacitor and resistance. And control signal SL which controls an extension circuit by the signal of the detected average luminance It outputs and is extension circuit 3R. It gives.
[0014] And extension circuit 3R About the clamp-voltage slack video signal inputted, it is the control signal SL from average-luminance detection and the extension level control circuit 5. It responds and a white or black side is elongated. Namely, transistor TR2 shown in drawing 2 when a clamp-voltage slack video signal is inputted Since it is the reversal amplifier of direct-current direct connection, it is a transistor TR3. TR4 When turned off, an amplifier gain GA is set to GA=R1 / R2 in approximation. And as shown in drawing 5 , it is a transistor TR2. 0IRE which was inputted into the base and which the video signal R fixes (black level) Control signal SL which receives and is changing according to average luminance Transistor TR3 When base potential becomes high, it is a transistor TR3. It is a transistor TR2 to base potential. It is a transistor TR3 to the video signal R of the period when base potential became low. It turns on.
[0015] Transistor TR3 If turned on, since power-terminal +B1 is grounded in alternating current, it is a transistor TR2. Parallel connection of the resistance R3 will be carried out to an emitter resistance R2, and it is a transistor TR3. The turned-on period is a transistor TR2. Gain becomes high and elongates a black side. Moreover, transistor TR4 Transistor TR3 A white side is elongated on the contrary. And transistor TR3 And transistor TR4 Each base bias is average luminance (APL). When it is 50%, and it is set as the potential which does not perform the gradation amendment by the side of white and black and average luminance becomes lower than a reference value, it is a control signal SL. When level became high, extension by the side of black is performed and average luminance becomes higher than a reference value on the contrary, the level of a control signal becomes low and elongates a white side.
[0016] Drawing 6 which shows an extension amendment property explains such extension operation. Transistor TR2 when not inputting a video signal R for 0.7 VP-P and extension operation When gain is made into 1 time and gain at the time of the extension by the side of white and black is made into double precision, it is extension circuit 3R. Gain characteristics move in the direction of a broken line b as it becomes a broken line a and average luminance becomes low, when average luminance is 50%. If average luminance becomes high on the contrary, it will move in the direction of a broken line c, and

extension operation by the side of white or black will be continuously performed according to average luminance.

[0017] And extension circuit 3R which performed extension operation An output signal is amplitude equalization circuit 4R. It is inputted. Amplitude equalization circuit 4R Video signal R0 to output It is inputted into clamp section 6a of the amplitude-control circuit 6, and is a video signal R0. A pedestal is clamped. The clamped voltage is inputted into sample and hold section 6b, the size of the reference signal of 100IRE(s) inserted in vertical-retrace-line period 1H is sampled, and the potential is held. and the held potential is inputted into error detecting-element 6c, and the size of the difference of hold potential and a reference potential, i.e., the reference signal of 100IRE(s), is always fixed as compared with a reference potential (0.7 VP-P) Control signal SCTR which can be made outputting -- amplitude equalization circuit 4R giving -- amplitude equalization circuit 4R from -- video signal R0 outputted Predetermined level is always stabilized.

gradation corrector

[0018] In addition, it is extension circuit 3R in this way. Control signal SL to give Extension circuit 3B and 3G It gives in common. here -- clamping circuit 1B, 1G, and 1R from -- amplitude equalization circuit 4B, 4G, and 4R up to -- since gain in the middle of each circuit is made the same -- extension circuit 3B, 3G, and 3R the inputted video signal -- the same property -- a gradation amendment -- things are made moreover, amplitude equalization circuit 4B, 4G, and 4R Control signal SCTR which the amplitude-control circuit 6 outputs since it controls in common -- amplitude equalization circuit 4B, 4G, and 4R from -- the video signal B0 to output and by which the gradation amendment was carried out, G0, and R0 An amplitude can be fixed and it can be made in agreement.

[0019] Thus, when extension operation is performed, the input-output behavioral characteristics of a video signal come to be shown in drawing 7 . Namely, if the average luminance of a video signal becomes lower than 50%, according to average luminance, it will shift in the direction of a broken line e, and if it becomes high from 50% on the contrary, according to average luminance, it will shift in the direction of a broken line f. If average luminance becomes low by this, a black side will be elongated according to average luminance, and a white side will be compressed on the contrary. Moreover, if average luminance becomes high, a white side will be elongated according to average luminance, and a black side will be compressed.

gradation

[0020] In order for the average luminance of a video signal to become low, and for an image to follow on becoming dark and to elongate a black side by this, the gradation expression capacity by the side of black is improved. If average luminance becomes high on the contrary, a white side will be elongated, the gradation expression capacity by the side of white will be improved, and the dynamic range on appearance will be expanded. And in a video signal in three primary colors, since a gradation amendment property may be made in agreement, the repeatability of a color is not spoiled. Moreover, a gradation amendment can be made to perform a video signal in three primary colors only by carrying out adjustment operation of appointing the starting position which controls the amplitude of the video signal which carried out the gradation amendment in the starting position and amplitude-control circuit which control extension level in average-luminance detection and an extension level control circuit, and complicated adjustment operation of adjusting many adjustment parts like before is not required.

[0021]

[Effect of the Invention] As explained in full detail above, if the average luminance of a video signal becomes low, this invention will elongate a black side and will compress a white side, and if average luminance becomes high, the dynamic range on the shell which elongates a white side and compressed the black side, and appearance is expandable. Moreover, since the amplitude of the video signal which each extension circuit and each extension circuit outputted is controlled in common, a difference does not arise in the property of a gradation amendment and the repeatability of a color is not spoiled. Moreover, since the amendment property of each video signal in three primary colors only by carrying out adjustment operation only of the control circuit level of extension level and the amplitude amendment start level of a video signal which carried out the gradation amendment can be made in agreement, the effect which was [be / no troublesomeness / in the remedial operation of gradation] excellent is done so.

[Translation done.]

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	9/30		8943－5C		
	9/72		8942－5C		

審査請求　未請求　請求項の数１(全　６　頁)

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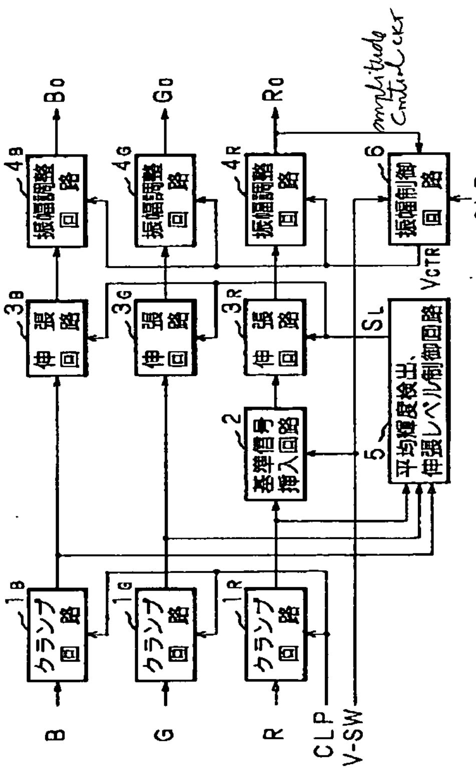
(54)【発明の名称】　液晶映像表示装置の階調補正回路

(57)【要約】

【目的】　色再現性の劣化を少なくして、簡単に階調補正できるようにする。

【構成】　映像信号Ｂ，Ｇ，Ｒは夫々のクランプ回路1_B，1_G，1_Rで同一電圧にクランプする。映像信号Ｒには、それをクランプした後に垂直帰線期間中の１ラインに基準信号を挿入する。クランプした映像信号Ｂ，Ｇ，Ｒから平均輝度検出、伸張レベル制御回路５で輝度信号を検出し、検出した平均輝度により伸張レベルを制御する制御信号S_Lを出力し、伸張回路3_Rへ入力し、映像信号Ｂ，Ｇ，Ｒを伸張回路3_B，3_G，3_Rで平均輝度に応じて階調補正を行う。振幅制御回路６は映像信号R_0に挿入されている基準信号を検出して、振幅調整回路4_B，4_G，4_Rを制御し、階調補正した映像信号B_0，G_0，R_0の振幅を常に一定にする構成にする。



【特許請求の範囲】

【請求項1】　液晶を用いて映像を表示する液晶映像表示装置の階調補正回路において、3原色の1つの映像信号のペデスタルを所定電圧にクランプした電圧が入力され、映像信号の垂直帰線期間内に所定の基準信号を挿入する基準信号挿入回路と、残りの2原色の映像信号のペデスタルを所定電圧にクランプした電圧が各別に入力される第1，第2の伸張回路と、前記基準信号挿入回路が出力する映像信号が入力される第3の伸張回路と、前記クランプした電圧が入力されて映像信号の平均輝度を検出して伸張レベルを制御する制御信号を出力する平均輝度検出、伸張レベル制御回路と、前記伸張回路が出力する映像信号に基づく映像信号が入力され、第1，第2，第3の伸張回路から出力された映像信号の振幅を制御する振幅制御回路とを備え、前記制御信号により、第1，第2，第3の伸張回路を共通に制御して映像信号の平均輝度が低い場合は黒側に伸張させ、平均輝度が高い場合は白側に伸張させる階調補正を行い、振幅制御回路により第1，第2，第3の伸張回路が出力した映像信号の振幅を共通に制御すべく構成してあることを特徴とする液晶映像表示装置の階調補正回路。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は液晶ビデオディスプレイ、液晶ビデオプロジェクタ等の液晶映像表示装置の階調補正回路に関するものである。

【0002】

【従来の技術】一般的に液晶ビデオディスプレイは、CRT ディスプレイと比較すると、映像の黒側と白側との間を表現するダイナミックレンジが狭く、暗部、明部での階調が壊れる。これを改善するために従来は固定の階調補正を行うか、または映像信号の平均輝度(APL) に対応して輝度信号（Y信号）に対し階調補正を行っている。また、映像信号の黒側の補正と、白側の補正とを各別に行っている。

【0003】

【発明が解決しようとする課題】このように、輝度信号に対して階調補正を行う場合は回路は1回路ですむが、クロマ信号に対して階調補正を行うことができないので、再生した映像の色の飽和度が変わって色の再現性が悪くなる。そのため高画質で映像の再現性を重視するハイビジョンディスプレイには適さない。また、3原色に対して階調補正を行う場合、3原色の映像信号夫々の階調補正特性にばらつきが生じると補正した部分の色の再現性が悪くなるので3原色の映像信号を階調補正する特性を完全に一致させる必要がある。したがって、従来、階調補正する場合には、3原色の映像信号の階調補正特性を個々に調整しなければならず、調整すべき箇所が多い、そのため3原色の階調補正を行う特性を合わせるために複雑な調整操作が必要であるという問題がある。

【0004】本発明は斯かる問題に鑑み、色の再現性を劣化させずに、階調補正を簡単な調整で行える液晶映像表示装置の階調補正回路を提供することを目的とする。

【0005】

【課題を解決するための手段】本発明に係る液晶映像表示装置の階調補正回路は、液晶を用いて映像を表示する液晶映像表示装置の階調補正回路において、3原色の1つの映像信号のペデスタルを所定電圧にクランプした電圧が入力され、映像信号の垂直帰線期間内に所定の基準信号を挿入する基準信号挿入回路と、残りの2原色の映像信号のペデスタルを所定電圧にクランプした電圧が各別に入力される第1，第2の伸張回路と、前記基準信号挿入回路が出力する映像信号が入力される第3の伸張回路と、前記クランプした電圧が入力されて映像信号の平均輝度を検出して伸張レベルを制御する制御信号を出力する平均輝度検出、伸張レベル制御回路と、前記伸張回路が出力する映像信号に基づく映像信号が入力され、第1，第2，第3の伸張回路から出力された映像信号の振幅を制御する振幅制御回路とを備え、前記制御信号により、第1，第2，第3の伸張回路を共通に制御して映像信号の平均輝度が低い場合は黒側に伸張させ、平均輝度が高い場合は白側に伸張させる階調補正を行い、振幅制御回路により第1，第2，第3の伸張回路が出力した映像信号の振幅を共通に制御すべく構成してあることを特徴とする。

【0006】

【作用】3原色の2つの映像信号のペデスタルをクランプした電圧を、第1，第2の伸張回路へ各別に入力する。残りの1つの映像信号のペデスタルをクランプした電圧に、垂直帰線期間内で基準信号を挿入して第3の伸張回路へ入力する。3原色の映像信号の夫々のペデスタルをクランプした電圧により平均輝度を検出して、その平均輝度により伸張レベルを制御する制御信号を作成して、各伸張回路へ与え、平均輝度が低い場合は黒側を伸長し、平均輝度が高い場合は白側を伸長するように、各伸張回路に入力された映像信号を共通に階調補正する。各伸張回路が出力した夫々の映像信号に基づく映像信号により、各伸張回路が出力した映像信号の振幅を所定値になすよう共通に制御する。これにより、平均輝度に応じて見かけ上のダイナミックレンジを拡大できる。また3原色の各映像信号の階調補正の特性を一致させ得る。

【0007】

【実施例】以下本発明をその実施例を示す図面により詳述する。図1は本発明に係る液晶映像表示装置の階調補正回路の構成を示すブロック図である。3原色の映像信号B，G，Rはクランプ回路1_B ，1_G ，1_R へ入力される。クランプ回路1_B ，1_G ，1_R には、ペデスタルをクランプするタイミングを定めるクランプパルスCLPが与えられる。クランプ回路1_B ，1_G がクランプした電圧たる映像信号は伸張回路3_B ，3_G へ入力され、伸

張回路3_B，3_Gが出力する映像信号は振幅調整回路4_B，4_Gへ入力される。クランプ回路1_Rがクランプした電圧は基準信号挿入回路２へ入力され、基準信号挿入回路２が出力する映像信号は伸張回路3_Rへ入力される。伸張回路3_Rが出力する映像信号は振幅調整回路4_Rへ入力される。

【０００８】100IREに相当する基準信号を挿入するタイミングを定めるための切換信号Ｖ－SWは、基準信号挿入回路２及び振幅制御回路６へ入力される。クランプ回路1_B，1_G，1_R夫々がクランプした電圧はともに平均輝度検出、伸張レベル制御回路５へ入力され、検出した平均輝度により作成された伸張レベルを制御する制御信号S_Lは伸張回路3_B，3_G，3_Rへ与えられる。振幅制御回路６が出力する制御信号S_{CTR}は振幅調整回路4_B，4_G，4_Rへ与えられる。振幅調整回路4_B，4_G，4_Rから階調補正を行った色信号B_0，G_0，R_0が出力され、色信号R_0は振幅制御回路６へ入力される。振幅制御回路６にはクランプパルスCLPが与えられる。

【０００９】図２は、伸張回路3_Rの構成を示す回路図であり、伸張回路3_B，3_Gも同様に構成される。信号入力端子3aはコレクタ接地のトランジスタTR1 のベースと接続され、そのエミッタはトランジスタTR2 のベースと接続され、抵抗R0を介して電源端子＋B1と接続される。電源端子＋B1はコンデンサ（図示せず）を介して交流的に接地される。トランジスタTR2 のエミッタは抵抗R2を介して接地され、抵抗R3を介してトランジスタTR3 のエミッタと、抵抗R4を介してコレクタ接地のトランジスタTR4 のエミッタと接続される。トランジスタTR2 のコレクタは抵抗R1を介して電源端子＋B1と接続され、抵抗R5を介してトランジスタTR5 のベースと接続される。

【００１０】トランジスタTR3 のコレクタは電源端子＋B1と接続され、そのベースは抵抗R6を介して接地され、抵抗R7,R8,R9の直列回路を介して電源端子＋B2と接続される。抵抗R8とR9との接続部はトランジスタTR4 のベースと接続される。抵抗R7とR8との接続部は、平均輝度検出、伸張レベル制御回路５からの伸長レベル制御電圧が入力される制御電圧入力端子3bと接続される。トランジスタTR5 のコレクタは電源端子＋B1と接続され、そのエミッタは階調補正された映像信号を出力する信号出力端子3cと接続され、抵抗R10 を介して接地される。

【００１１】図３は振幅制御回路６の構成を示すブロック図である。振幅制御回路６はクランプ部6a、サンプル、ホールド部6b及び誤差検出部6cにより構成される。クランプ部6aには、振幅調整回路4_R（図１参照）が出力する階調補正された映像信号R_0が入力され、またクランプパルスCLP が与えられる。クランプ部6aが出力する映像信号はサンプル、ホールド部6bへ入力される。サンプル、ホールド部6bには切換信号Ｖ－SWが与えられる。サンプル、ホールド部6bが出力する信号は誤差検出部6cに入力され、誤差検出部6cは振幅調整回路4_Rへ与える制御信号S_{CTR}を出力する。

【００１２】次にこのように構成した液晶映像表示装置の階調補正回路の動作を説明する。なお、映像信号Ｒ、Ｇ、Ｂはいずれも同様に階調補正が行われるようにしているため、映像信号Ｒについて説明する。クランプ回路1_Rに映像信号Ｒが入力されると、クランプ回路1_Rは入力された映像信号ＲのペデスタルをクランプパルスCLP のタイミングでクランプし、クランプした電圧を出力し、基準信号挿入回路２へ入力する。なお、クランプ基準電圧は映像信号Ｒ，Ｇ，Ｂの夫々に同じ電源を使用して映像信号Ｒ，Ｇ，Ｂ間にクランプ電圧のばらつきが生じないようにする。

【００１３】クランプ回路1_Rが出力するクランプ電圧が基準信号挿入回路２へ入力されると、基準信号挿入回路２は図４に示すように映像信号Ｒの垂直帰線期間1H内に、切換信号Ｖ－SWにより100IREに相当する基準信号を挿入する。一方、クランプ回路1_Rからのクランプ電圧が平均輝度検出、伸張レベル制御回路５へ入力されて、平均輝度検出、伸張レベル制御回路５は映像信号Ｒの３原色の映像信号により輝度信号を得るマトリクス回路で輝度信号（Ｙ信号）を作成して、コンデンサと抵抗とからなる積分回路によって平均輝度を検出する。そして、検出した平均輝度の信号により伸張回路を制御する制御信号S_Lを出力し、伸張回路3_Rへ与える。

【００１４】そして伸張回路3_Rに入力されているクランプ電圧たる映像信号を、平均輝度検出、伸張レベル制御回路５からの制御信号S_Lに応じて白側又は黒側を伸張する。即ち、クランプ電圧たる映像信号が入力された場合、図２に示すトランジスタTR2 は直流直結の反転アンプであるから、トランジスタTR3 とTR4 とがオフしているときにはアンプゲインGAは、近似的にGA＝R1／R2となる。そして図５に示すようにトランジスタTR2 のベースに入力された、映像信号Ｒの一定している０IRE(黒レベル）に対して平均輝度に応じて変化している制御信号S_LによりトランジスタTR3 のベース電位が高くなった場合には、トランジスタTR3 のベース電位に対し、トランジスタTR2 のベース電位が低くなった期間の映像信号Ｒに対してトランジスタTR3 がオンする。

【００１５】トランジスタTR3 がオンすると電源端子＋B1が交流的に接地されているから、トランジスタTR2 のエミッタ抵抗R2に対し抵抗R3が並列接続された状態になり、トランジスタTR3 がオンしている期間はトランジスタTR2 のゲインが高くなり、黒側を伸張する。また、トランジスタTR4 はトランジスタTR3 とは反対に白側を伸張する。そして、トランジスタTR3 及びトランジスタTR4 の夫々のベースバイアスは平均輝度(APL) が50％のとき白側及び黒側の階調補正を行わない電位に設定し、平均輝度が基準値より低くなった場合に制御信号S_Lのレベルが高くなり黒側の伸張を行い、反対に平均輝度が基

準値より高くなった場合は制御信号のレベルが低くなり白側を伸張する。

【0016】このような伸長動作を伸張補正特性を示す図6により説明する。映像信号Rの入力を0.7 V_{P-P} 、伸張動作を行わない場合のトランジスタTR2 のゲインを1倍とし、白側、黒側の伸張時のゲインを2倍としたとき、伸張回路3_R のゲイン特性は、平均輝度が50%の場合は折線ａとなり、平均輝度が低くなるにしたがって折線ｂの方向へ移動する。反対に平均輝度が高くなると折線ｃの方向へ移動し、平均輝度に応じて連続的に白側又は黒側の伸張動作を行う。

【0017】そして伸張動作を行った伸張回路3_R の出力信号は振幅調整回路4_R へ入力され、振幅調整回路4_R が出力する映像信号R_0 は振幅制御回路６のクランプ部6aへ入力され、映像信号R_0 のペデスタルをクランプして、クランプした電圧をサンプル、ホールド部6bに入力し、垂直帰線期間1Hに挿入されている100IREの基準信号の大きさをサンプリングして、その電位をホールドする。そしてホールドした電位を誤差検出部6cへ入力して基準電位と比較し、ホールド電位と基準電位との差、即ち100IREの基準信号の大きさが常に一定（0.7 V_{P-P} ）になし得る制御信号S_{CTR} を出力して振幅調整回路4_Rへ与えて、振幅調整回路4_R から出力される映像信号R_0 を常に所定レベルに安定させる。

【0018】なお、このように伸張回路3_R に与える制御信号S_L を伸張回路3_B ，3_G に共通に与える。ここでクランプ回路1_B ，1_G ，1_R から振幅調整回路4_B ，4_G ，4_R までの夫々の回路途中のゲインを同一にしているので、伸張回路3_B ，3_G ，3_R に入力された映像信号を同一特性で階調補正することができる。また振幅調整回路4_B ，4_G ，4_R を、振幅制御回路６が出力する制御信号S_{CTR} により共通に制御するから、振幅調整回路4_B ，4_G ，4_R から出力する階調補正された映像信号B_0 ，G_0 ，R_0 の振幅を、一定にでき一致させることができる。

【0019】このようにして伸張動作を行った場合には、映像信号の入出力特性は図７に示すようになる。即ち、映像信号の平均輝度が50%より低くなると、平均輝度に応じて折線ｅの方向へ移行し、反対に50%より高くなると平均輝度に応じて折線ｆの方向へ移行する。これにより平均輝度が低くなれば平均輝度に応じて黒側を伸張し、白側を反対に圧縮する。また平均輝度が高くなると、平均輝度に応じて白側を伸張し、黒側を圧縮する。

【0020】これにより、映像信号の平均輝度が低くなり、映像が暗くなるにともなって黒側を伸張するため、黒側の階調表現能力を改善する。反対に平均輝度が高くなると白側を伸張し、白側の階調表現能力を改善することになり、見かけ上のダイナミックレンジを拡大することになる。そして３原色の映像信号を階調補正する特性を一致させ得るから、色の再現性が損なわれない。また、平均輝度検出、伸張レベル制御回路において伸長レベルを制御する開始位置及び振幅制御回路において階調補正した映像信号の振幅を制御する開始位置を定める調整操作をするのみで３原色の映像信号を階調補正を行わせることができ、従来のように多い調整箇所を調整する等の複雑な調整操作を要しない。

【0021】

【発明の効果】以上詳述したように本発明は映像信号の平均輝度が低くなれば黒側を伸長して白側を圧縮し、平均輝度が高くなれば白側を伸張して黒側を圧縮するようにしたから、見かけ上のダイナミックレンジを拡大できる。また各伸張回路及び各伸張回路が出力した映像信号の振幅を共通に制御するから階調補正の特性に差が生じず色の再現性が損なわれない。また伸張レベルの制御回路レベル及び階調補正した映像信号の振幅補正開始レベルのみを調整操作するだけで３原色の映像信号夫々の補正特性を一致させることができるから階調の補正操作に煩わしさがない等の優れた効果を奏する。

【図面の簡単な説明】

【図１】本発明に係る液晶映像表示装置の階調補正回路の構成を示すブロック図である。

【図２】伸張回路の構成を示す回路図である。

【図３】振幅制御回路の構成を示す回路図である。

【図４】映像信号に基準信号を挿入した信号の波形図である。

【図５】伸張回路の動作説明図である。

【図６】伸張回路の入出力特性図である。

【図７】平均輝度に対する階調補正特性図である。

【符号の説明】

1_B ，1_G ，1_R クランプ回路

２ 基準信号挿入回路

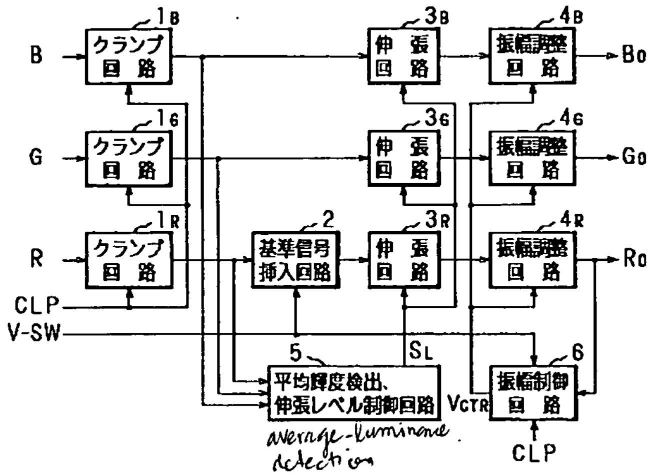
3_B ，3_G ，3_R 伸張回路

4_B ，4_G ，4_R 振幅調整回路

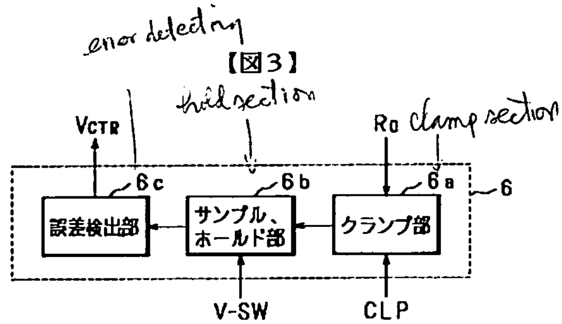
５ 平均輝度検出、伸張レベル制御回路

６ 振幅制御回路

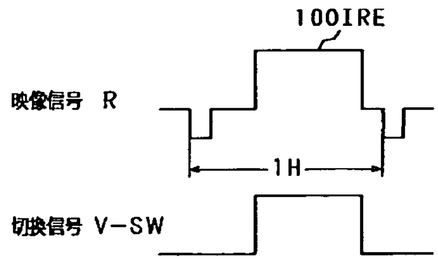
【図1】



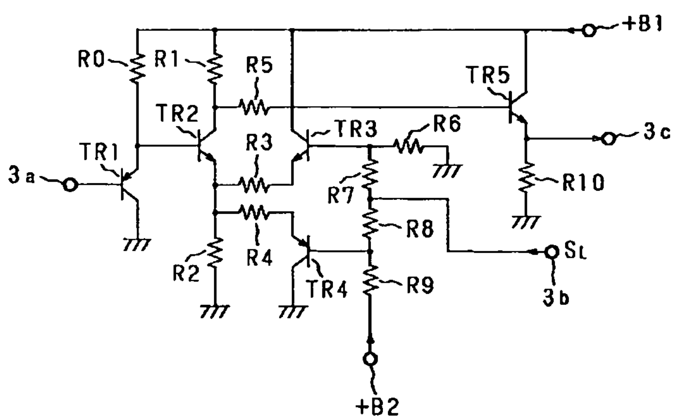
【図3】



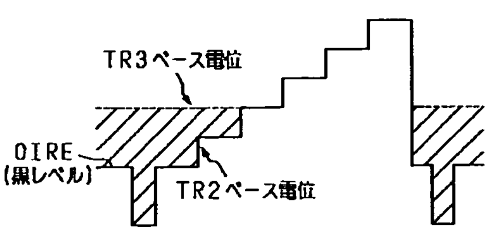
【図4】



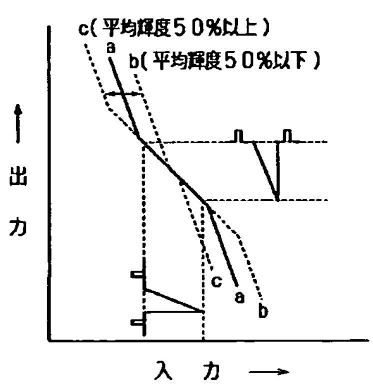
【図2】



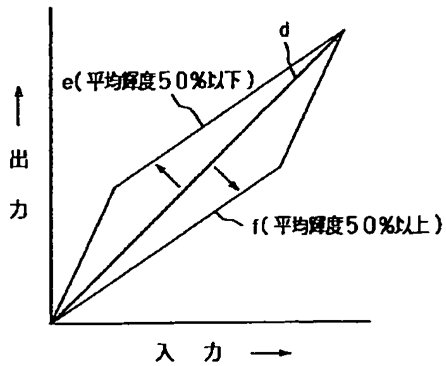
【図5】



【図6】



【図7】



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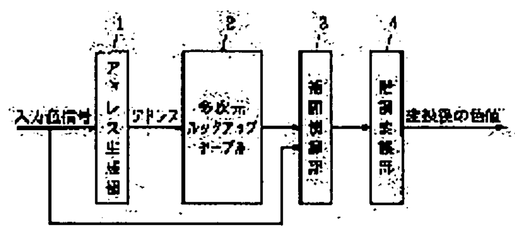
(72)Inventor : TAGUCHI TOMOKO

(54) COLOR CONVERTING DEVICE AND METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide the color converting device and method by which precision in color conversion is improved without increasing the capacity of multi- dimensional look-up table.

SOLUTION: A correction value is set so as to attain desired color conversion as much as possible by permitting a value out of a range taken by a color value after conversion concerning grid point data by which the boundary value of the range for the color value after conversion is obtained in the multi- dimensional look-up table 2. When a color conversion processing is executed, a color signal to be converted is inputted to an address generating part 1, an interpolation processing is executed in an interpolation arithmetic part 3 by grid point data which is outputted from the table 2 in accordance with the generated address and the color value after conversion corresponding to the inputted color signal is obtained. At this time, it is converted into the boundary value by a hierarchy converting part 4 when the value becomes the one out of the range taken by the color value after conversion.



DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the color inverter and the color conversion method of changing into the color value of the predetermined range from the chrominance signal of the inputted color picture data.
[0002]
[Description of the Prior Art] Color transform processing which changes the inputted chrominance signal of a pixel into other color values conventionally using a multi-dimension look-up table and interpolation is performed. In color digital output equipment etc., color conversion to the color value of the color space for output processing from the chrominance signal of the color space for internal processing is performed especially. In such color conversion, for example compared with methods, such as a matrix operation, the color conversion including the color correction to the local field in a color space is possible, and a good color-reproduction property can be acquired.
[0003] If the color value after the conversion corresponding to all the values of the chrominance signal in which it is inputted and deals is stored, color conversion can be correctly performed in a multi-dimension look-up table. However, though the chrominance signal inputted is dispersed digital data, there are very many the values which can be taken, and an immense capacity is needed in order to store the color value after corresponding conversion. Therefore, the color space of the chrominance signal usually inputted is divided into a multi-dimension look-up table, and the method of making the color value after conversion hold is used for it only in the lattice point of the divided color space. Drawing 12 is explanatory drawing of the lattice point which makes a color value hold to a multi-dimension look-up table. At drawing 12 , it is L*. A shaft and a* A shaft and b* The 3-dimensional color space which consists of a shaft is divided as a dashed line shows, and the color value after conversion is made to hold to a multi-dimension look-up table about the lattice point shown by the black dot which a dashed line intersects. At this time, they are L*, a*, and b* at each lattice point. Since the value was decided, they are this L*, a*, and b*. The address is made to correspond to the group of a value and the color value after changing into each address is made to hold. And L* of the inputted chrominance signal, a*, and b* What is necessary is to generate the address from a value, to input into a multi-dimension look-up table, and just to read the color value after conversion. In addition, when the inputted chrominance signal is except the lattice point, interpolation processing can be carried out from the color value of the lattice point of the neighborhood stored in the multi-dimension look-up table, and the color value after conversion can be calculated. Moreover, if the color value in a different color space is stored as a color value after the conversion stored in the multi-dimension look-up table, it is possible to also perform a color space conversion.
[0004] However, by this method, in order to decrease the capacity of a multi-dimension look-up table, the number of the lattice points will be limited. Therefore, when the capacity of a multi-dimension look-up table is decreased, the number of partitions of a color space will be limited, the interval of the lattice point in a color space becomes large, and operation precision falls. Drawing 13 is explanatory drawing of an example of the trouble at the time of the color conversion which used the multi-dimension look-up table. In drawing 13 , the color value after the conversion corresponding to a vertical axis for the chrominance signal inputted into a horizontal axis is taken. In the point of a black dot, the color value after changing into a multi-dimension look-up table shall be stored. Only the value after the conversion in the lattice point A and the lattice point B is stored in the multi-dimension look-up table to perform color conversion as shown by the thick line now. Therefore, by the above-mentioned method, at section A-B, color conversion as shown by the dotted line by interpolation processing is performed, and an error as shown by hatching arises. This error will appear as muddiness of a color.
[0005] Thus, by the method using the multi-dimension look-up table, in order to depend for the operation precision of color transform processing on the size of a multi-dimension look-up table, when the size is not enough, depending on the position in a color space, operation precision also becomes

inadequate and an error will arise in the color value after conversion. By this, the chrominance signal which originally does not exist in the picture signal outputted occurs, and it may become the cause of quality-of-image degradation, such as mixing of a color.

[0006] Especially the error of such a color value is generated near the boundary of the range of the color value which the color value after conversion can take. In the example shown in drawing 13 , the color value after conversion is made or more into zero, and the error of a color value has occurred [near / which is the minimum of the range of a color value / the zero]. The error of such a color value may be generated also near the upper limit of the range of a color value.

[0007] In the color conversion method using such a multi-dimension look-up table, in order to raise the precision of color conversion, various methods are developed. For example, it thinks, using methods, such as triangle pole interpolation and slanting triangle pole interpolation, as the interpolation method as indicated by JP,7-99587,A, JP,9-69961,A, etc. However, by these methods, since it was dependent on the size of a look-up table, the error as performed and showed hatching by drawing 13 occurred, and interpolation precision was not able to avoid quality-of-image degradation, either, when the size of a table was not enough.

[0008]

[Problem(s) to be Solved by the Invention] this invention aims at offering the color inverter and the color conversion method which raised the precision of color conversion, without having been made in view of the situation mentioned above, and increasing the capacity of a multi-dimension look-up table.

[0009]

[Means for Solving the Problem] In order that especially this invention may reduce the error in near the boundary of the predetermined range which the color value after conversion can take to which color conversion precision falls, it also permits the value besides the predetermined range as a color value after the conversion stored in a multi-dimension look-up table, and is brought close to the value after the color conversion which should originally perform the color value after interpolation processing. Since the error at the time of the color conversion generated near the boundary of the predetermined range can be decreased by this, color conversion precision can improve and faults, such as mixing of the color by the conversion error, can be prevented. In addition, with this, since the value besides the predetermined range may exist as a color value after conversion, when the color value after interpolation processing is outside the predetermined range, it has changed so that it may become predetermined within the limits. Moreover, when it is the composition that the value besides the predetermined range is unstorable as a value stored in a multi-dimension look-up table, compression processing is carried out so that it may become a predetermined range also including the value besides the predetermined range, and it may be made to perform extension processing before interpolation processing or after interpolation processing.

[0010]

[Embodiments of the Invention] Drawing 1 is the block diagram showing one gestalt of operation of the color inverter of this invention. For one, as for a multi-dimension look-up table and 3, the address-generation section and 2 are [interpolation operation part and 4] gradation transducers among drawing. The address-generation section 1 generates the address of the multi-dimension look-up table 2 according to the inputted chrominance signal. At this time, the address corresponding to two or more lattice points used for a interpolation operation by the interpolation operation part 3 is also generable. In addition, when it is what can use directly the chrominance signal into which the multi-dimension look-up table 2 was inputted as the address, it is also possible to constitute without forming this address-generation section 1.

[0011] The multi-dimension look-up table 2 holds the color value after the conversion in each lattice point of space which divided the color space which consists of a value of the chrominance signal inputted to the address corresponding to each lattice point. As a color value after conversion, the value out of range which the color value after conversion can take is also permitted, and it is made for the color value after the interpolation processing in the interpolation operation part 3 to approach the value after the color conversion which should originally be performed. When the multi-dimension look-up table 2 cannot store a value with the color value out of range as a maintenance possible value after

conversion at this time, compression processing can be carried out so that it can hold by the multi-dimension look-up table 2 also including a value out of range. In case color conversion is performed, the color value after the conversion currently held is outputted according to the address inputted from the address-generation section 1.
[0012] The interpolation operation part 3 performs a interpolation operation based on the color value after the conversion read from the multi-dimension look-up table 2, and calculates the color value after conversion of the inputted chrominance signal. The method of interpolation is arbitrary, generates the address of the lattice point which is needed for interpolation in the address-generation section 1 according to the interpolation method to be used, inputs it into the multi-dimension look-up table 2, and should just read the color value after required conversion from the multi-dimension look-up table 2.
[0013] The gradation transducer 4 is changed into the value within the limits of it when it becomes out of range [the color value after the value the interpolation operation was carried out / the value / by the interpolation operation part 3 changing]. In this invention, since the value out of range which the color value after conversion can take is also permitted as a color value after the conversion made to hold to the multi-dimension look-up table 2, the color value after a interpolation operation may turn into a value which deviated from this range. In the gradation transducer 4, it has prevented that the value which deviated from such a range is outputted as it is. Moreover, since it is the value into which the value in which the interpolation operation was carried out by the interpolation operation part 3 was also compressed when the value after the conversion stored in the multi-dimension look-up table 2 is a value by which compression processing was carried out, extension processing is performed in this gradation transducer 4. In deviating from the range of the color value after the elongated value changing, it changes into a color value within the limits similarly. As a color value within the limits to change, it can consider as the lower limit and lower limit of the range, corresponding to the direction which deviates from the range.
[0014] Although extension processing was performed in the gradation transducer 4 here when the value after the conversion stored in the multi-dimension look-up table 2 was a value by which compression processing was carried out, you may constitute so that transform processing may be performed when the value after conversion is read, for example from the multi-dimension look-up table 2, and interpolation processing may be performed in the interpolation processing section 3 after that.
[0015] Next, operation in one gestalt of operation of the color inverter of this invention is explained. L* a* b* whose color space of the chrominance signal inputted as an example in the following explanation is three dimensions They shall be a color space and the YMCK color space whose color space of the color value after conversion is four dimensions. Since the color space of the chrominance signal inputted is three dimensions, the multi-dimension look-up table 2 also becomes three dimensions, and will hold the color value of a YMCK color space as each lattice point data.
[0016] First, the setting method of the color value after conversion to the multi-dimension look-up table 2 is explained. The multi-dimension look-up table 2 shall divide the color space which consists of values which the chrominance signal inputted can take into 16 subspaces (4 bits) for every shaft, and shall hold the color value after the conversion in the lattice point (17x17x17=4913 point) of 4096 subspaces (=16x16x16) formed of division here. Moreover, the multi-dimension look-up table 2 shall hold 8 bits of values of 0-255 for 0% - 100% of Y, M, C, and K each value respectively as a color value after the conversion held for every lattice point.
[0017] Drawing 2 is a flow chart which shows an example of the creation method of the lattice point data stored in a multi-dimension look-up table in one gestalt of operation of the color inverter of this invention. In case the color value after the conversion made to store in the multi-dimension look-up table 2 is determined, it sets to S11 first, and they are L*, a*, and b*. More numbers of partitions than 16 division divide a color space for every shaft, and the color value after the conversion in each lattice point is calculated. Here, a color space is divided into 32 pieces (=5 bit). And in S12, the value (Y, M, C, K) corresponding to the value in each lattice point of the space divided into 32 pieces (L*, a*, and b*) is computed. In addition, each value of Y, M, C, and K is computable as a value of 0% - 100% of range. The various methods learned conventionally can be used for the method of calculation. Drawing 3 is

explanatory drawing of an example of the lattice point data at the time of carrying out a fragmentation rate. It sets to drawing 3 and is L* a* b*. A certain flat surface parallel to a certain shaft in a color space is shown, a black dot is the lattice point in the case of 16 division, and the lattice point in the case of 32 division turns into a point of a black dot and a white round head. A value (Y, M, C, K) is computed about the lattice point of both a black dot and a white round head. Here, the C values of the color values acquired about a part of lattice points should be 0%, 5%, and 13% as an example.
[0018] In S13, about all the lattice points at the time of dividing into 16, it investigates whether it is set as the object of an amendment, and a value (Y, M, C, K) is amended [lattice point / which is set as the object of an amendment] in S14. Here, the case where amendment processing in the portion near 0% which is a minimum among 0% - 100% of values which are the ranges which each color value can take is performed is described. In addition, this processing is performed for every color of Y, M, C, and K.
[0019] Drawing 4 is a flow chart which shows an example of extraction of the point for an amendment, and amendment processing. In S21, the color value of the lattice point at the time of dividing into 16 judges whether it is 0%. Since an error as shown in drawing 13 will not be produced if a color value is not 0%, an amendment is not performed. About the lattice point whose color value is 0%, the following processings are performed by making the lattice point into the attention lattice point. In S22, the point that the whole of the color value is not 0% or 0% judges [1 or] whether more than one exist in the neighbor point of using with the attention lattice point in the case of the interpolation operation in the interpolation operation part 3. If it is 0% altogether in the neighbor point of using in the case of a interpolation operation, the result of a interpolation operation will also be 0% and there will be no amendment need about the color value of the attention lattice point. When at least one color value is not 0% in the neighbor point of using in the case of a interpolation operation, in S23, the correction value in the attention lattice point is computed using the color value in the lattice point at the time of dividing into 32 located between the attention lattice point and a neighbor point. A color value computes calculation of this correction value between each neighbor point which is not 0%. When there is a point which is not 0% of the neighbor point of using in the case of a interpolation operation When two or more neighbor points which are not 0% exist that what is necessary is just to apply the correction value of the attention lattice point computed from one of them in S25 What is necessary is just to determine suitable arbitrary values as correction value of the attention lattice point among the ranges which the correction value computed between each neighbor point and the attention lattice point in S24 takes.
[0020] Drawing 5 is explanatory drawing of an example of the calculation method of the correction value in the attention lattice point. For example, as shown in drawing 3 , as a result of calculating the color value in each lattice point which divided the color space into 32, C= 0% of point exists by this example. This point is also the lattice point in the case of 16 division, and makes this lattice point the attention lattice point. Moreover, C= 13% of point of the right-hand side may turn into a neighbor point in the case of 16 division. Drawing 5 shows the position of each lattice point in a color space to a horizontal axis, and shows the color value (only C value) of each lattice point to the vertical axis. Moreover, the dashed line shows the graph of the color value which it is going to acquire by this color conversion.
[0021] The correction value of the attention lattice point can be fundamentally calculated by straight-line approximation from a neighbor point, and the attention lattice point and the lattice point of 32 division which exists between neighbor points. Since the color value of the lattice point of 32 division which exists between the attention lattice point and a neighbor point is C= 5%, it is approximated in the straight line shown as the solid line which passes along this value and C= 13% of values of a neighbor point. This straight line makes correction value the value taken in the position of the attention lattice point. In this example, it becomes C=-3%. The color values after the conversion in the lattice point were 0-255 about each component. This correction value deviates from this range. In this invention, even if it is the correction value which deviated from the range which a color value can take in this way, it approves.
[0022] Drawing 6 and drawing 7 are explanatory drawings of an example of the lattice point used by calculation of the correction value centering on the attention lattice point. Drawing 5 showed the

example which computes the correction value in the attention lattice point about one neighbor point. As mentioned above, the correction value in the attention lattice point is computed about each of a neighbor point which may be used by the amendment operation in the amendment operation part 3. Here, the case where an amendment operation is performed using a triangle pole method is shown. Drawing 6 shows the attention lattice point in three dimensions as a center, and shows A or E flat surface in drawing 6 to drawing 7 , respectively. The attention lattice point exists in C flat surface. Moreover, B flat surface and D flat surface are flat surfaces in which the lattice point at the time of 32 division exists, respectively, and the lattice point at the time of 16 division does not exist in this flat surface. Moreover, in drawing 6 and drawing 7 , O shows the attention lattice point and, as for M0-M19, the lattice point at the time of 16 16 division, and N0-N19 are the lattice points at the time of 32 division.
[0023] It is the correction value [in / the attention lattice point O / respectively / like / points / neighbor / M6 and M13 / which exist in right above / of the attention lattice point O /, and directly under / the attention lattice point O, the neighbor points M0-M5 which exist in the same C flat surface, and] drawing 5] Oi. It can ask. Namely, Oi =2 nickel-Mi (6 i=0- 13)
It can ask by carrying out. It is correction value Oi as follows so that direct influence may be reduced since distance with the attention lattice point O becomes far although it can also ask similarly about other neighbor points. It computes. Drawing 8 is explanatory drawing of an example of the calculation method of the correction value corresponding to the neighbor point far from the attention lattice point. For example, when calculating the correction value O19 of the attention lattice point O corresponding to the neighbor point M19 and it solves about O from N'=(M13+M19)/2N5=(O+M5)/2N19= (N'+N5) / 2, it it is O19=4N19. - (M19+M5+M13)
It becomes. When it becomes common using the grant method of a sign which showed this in drawing 6 and drawing 7 , about M7-M12, it is Oi =4nickel. - (Mi+M(i-7)+M6)
About M14-M19, it is Oi =4nickel. - (Mi+M(i-14)+M13)
It is alike and, therefore, is the correction value Oi of the attention lattice point O. It can ask.
[0024] Thus, the correction value of the attention lattice point is calculated from the correction value of 20 pieces calculated from 20 neighbor points. If it is the value within the limits which the correction value of 20 pieces, such as setting it as either of the obtained correction value of 20 pieces as correction value of the attention lattice point, takes, it is good at any value. For example, average O=1/20sigmaOi is calculated and it is good also as correction value of the attention lattice point.
[0025] It returns to drawing 2 , and after computing correction value about the lattice point which became a candidate for an amendment as mentioned above, in S15, the multi-dimension look-up table 2 is built only using the color value of the lattice point in the case of 16 division. The correction value of the lattice point obtained as mentioned above may have deviated from the range which the color value after conversion can take. In this invention, the correction value which deviated from the range which the color value after conversion can take in this way is permitted. However, in the example shown, for example in drawing 5 depending on the composition of the multi-dimension look-up table 2, although the correction value of the attention lattice point takes a negative value, it may be unable to express a negative value depending on the composition of the multi-dimension look-up table 2. In this case, since it corresponds, in S16, the value of the range which contains correction value with the color value after conversion is compressed into the range which the multi-dimension look-up table 2 can take, and is stored in the multi-dimension look-up table 2.
[0026] Drawing 8 is explanatory drawing of an example of data compression processing. In drawing 8 , the value which stores the color value of the lattice point in a vertical axis at the multi-dimension look-up table 2 is shown in the horizontal axis. Usually, although the color value of Y, M, C, and K takes 0% - 100% of value, it is changed into the range (0-255) which the multi-dimension look-up tables 2 including the negative value from which it deviates from this range can take by amendment processing of the color value in the lattice point, for example. Drawing 8 shows the case where it compresses in alignment. Of course, it is not restricted to such a compression method. In addition, in drawing 8 , one certain color of Y, M, C, and K is shown, and same compression is performed about each color. And the compressed value is set as the multi-dimension look-up table 2. Thus, the color value after the

compressed conversion will be set to the address corresponding to each lattice point of the multi-dimension look-up table 2.

[0027] In case color transform processing is performed using the multi-dimension look-up table 2 to which the color value after conversion was set as mentioned above, the chrominance signal which should carry out color conversion is inputted into the address-generation section 1. In the address-generation section 1, the address of the lattice point used by the interpolation operation in the interpolation operation part 3 corresponding to the inputted chrominance signal is generated, and it inputs into the multi-dimension look-up table 2. The multi-dimension look-up table 2 reads and outputs the color value after the compressed conversion which is stored in the address inputted from the address-generation section 1. The interpolation operation part 3 calculates the color value after the compressed conversion corresponding to the inputted chrominance signal according to a interpolation operation using the color value after the conversion into which each lattice point outputted from the multi-dimension look-up table 2 was compressed.

[0028] Drawing 9 is explanatory drawing of an example of the data extension processing in a gradation transducer. As drawing 8 explained, in case the value of the lattice point of the multi-dimension look-up table 2 is set up, when compression processing has been performed, it is the value into which the value acquired by the interpolation operation in the interpolation operation part 3 was also compressed. Therefore, extension processing is performed in the gradation transducer 4, and an actual output value is generated. In drawing 9 , it is the value which performed the interpolation operation in the interpolation operation part 3, and a vertical axis is an output value. Here, extension processing is performed in alignment. When the compressed color value is beyond the value k so that drawing 8 may also show, it is the value of effective within the limits as a color value to output. Namely, the interpolation result of an operation should just change into the value (0-255) which can be taken as an output value about the value beyond a value k. It is the value which has deviated from the range which can be taken as a color value from the first in the case of a value with the interpolation result of an operation smaller than a value k. In this case, the output value is compulsorily made into the lower limit (0 [in this case]).

[0029] In addition, when setting up the value which has not performed compression processing as a value of the lattice point of the multi-dimension look-up table 2, it is not necessary to perform extension processing in the gradation transducer 4. However, since the interpolation result of an operation may serve as a value which deviates from the range of an output value, transform processing set as a value, for example, a lower limit, and a upper limit within the limits in that case is required. Moreover, it is also possible to perform gradation transform processing including the amendment processings (for example, gamma conversion etc.) which took the property of an output side into consideration in addition to this in the gradation transducer 4.

[0030] Drawing 10 is explanatory drawing of an example of the color transfer characteristic in one gestalt of operation of the color inverter of this invention. By drawing 10 , it is made to correspond to above-mentioned drawing 5 , and only the portion with one certain color is shown. By performing color transform processing as mentioned above, color transform processing as shown in drawing 10 by the thick line can be performed. This is the color transfer characteristic of the request shown with the dashed line closely compared with the conventional color transfer characteristic shown by the thin line. Therefore, generating of muddiness of a color etc. can be suppressed. The fault that a color will ride and color into a white portion can be reduced by making a YMCK color space into an output color space as mentioned above, and suppressing an error in the about 0% especially. Although the above-mentioned example shows only the amendment processing in about 0%, effects, such as suppressing coloring in a black portion, are expectable by performing amendment processing in about 100%. Of course, it is not restricted to the color space of an output side being a YMCK color space, and though it is other color spaces, the good color transfer characteristic can be obtained.

[0031] Drawing 11 is the block diagram showing the application of one gestalt of operation of the color inverter of this invention. For the input-side color transform-processing section and 33, as for a color transducer and 35, a matrix color transducer and 34 are [31 / a picture read station and 32 / the output side color transform-processing section and 36] the output sections among drawing. This application

shows the example which applied the color inverter of this invention to the copying machine etc.

[0032] The picture read station 31 has optoelectric transducers, such as CCD, reads a picture optically, and outputs it as a chrominance signal. The color space at this time is a RGB color space. The input-side color transform-processing section 32 performs color transform processing according to the property of the picture read station 31 while changing into the color space for internal processing (L* a* b* color space) the color space (RGB color space) of the chrominance signal outputted from the picture read station 31. As the input-side color transform-processing section 32, it can constitute from a look-up table etc. The matrix color transducer 33 performs data processing using the matrix of 3x9 as opposed to a chrominance signal, and performs color conversion to the whole picture.

[0033] The color transducer 34 is constituted by the color inverter of this invention, by the multi-dimension look-up table 2, bundles up local color transform processing in a color space, transform processing (GAMATTO (GAMUT) compression processing) to the color which can reproduce a color unreproducible in the output section 36, the color space conversion processing to the color space (YMCK color space) which the output section 36 receives, etc., and performs them.

[0034] The output side color transform-processing section 35 performs color transform processing according to the property of the output section 36. The output section 36 reproduces a picture on a record medium-ed, in response to the fact that the signal of a YMCK color space.

[0035] In such a system, since the color inverter of this invention is used for the color transducer 34 and the error at the time of the color conversion in near the boundary of the range of the color value generated in this portion is reduced conventionally, when a picture is reproduced in the output section 36, faults, such as mixing of a color, decrease and a high-definition picture can be acquired.

[0036] although the application to a copying machine was shown here -- as some of image formation equipments, such as picture input devices, such as not only this but a scanner, and a printer, and image processing systems -- etc. -- various application is possible

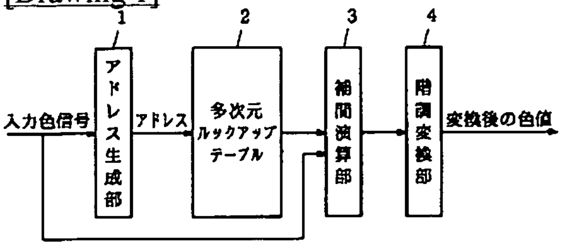
[0037]

[Effect of the Invention] According to this invention, the value out of range which the color value after conversion can take is also permitted as a color value after the conversion stored in a multi-dimension look-up table so that clearly from the above explanation. Color conversion precision can improve by this, the error in near the boundary of the range which the color value after conversion can take is reduced, it can bring close to the value after the color conversion which should originally perform the color value after interpolation processing, and faults, such as mixing of the color by the conversion error, can be canceled. It is not necessary to increase the capacity of a multi-dimension look-up table, and according to this invention, there are various effects at this time -- color transform processing can be performed without also reducing operation speed.

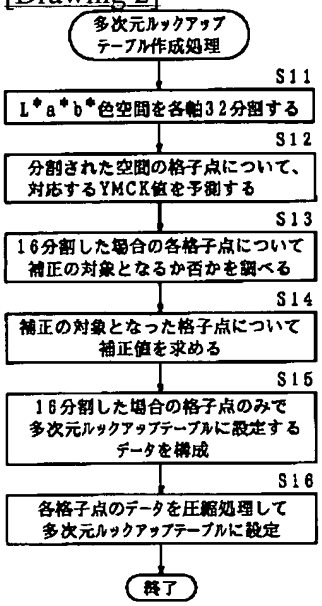
[Translation done.]

DRAWINGS

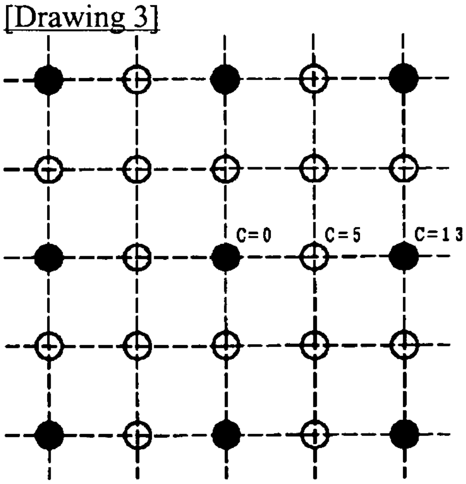
[Drawing 1]



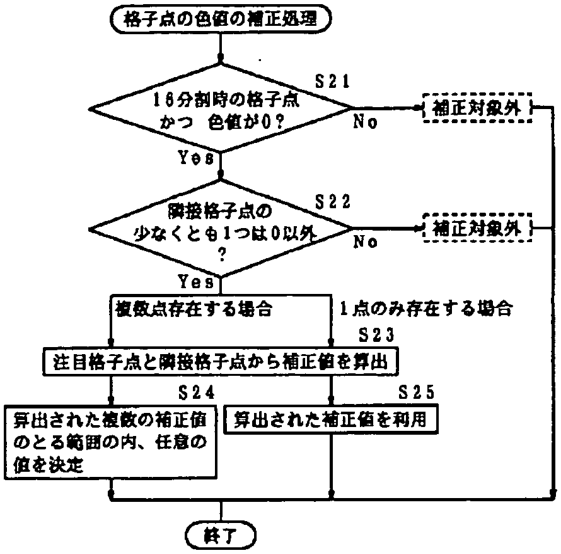
[Drawing 2]



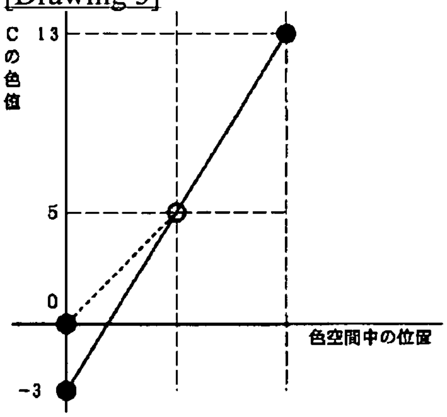
[Drawing 3]



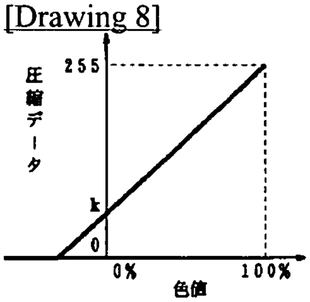
[Drawing 4]



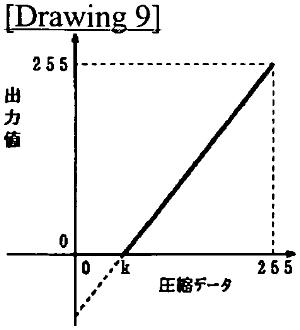
[Drawing 5]



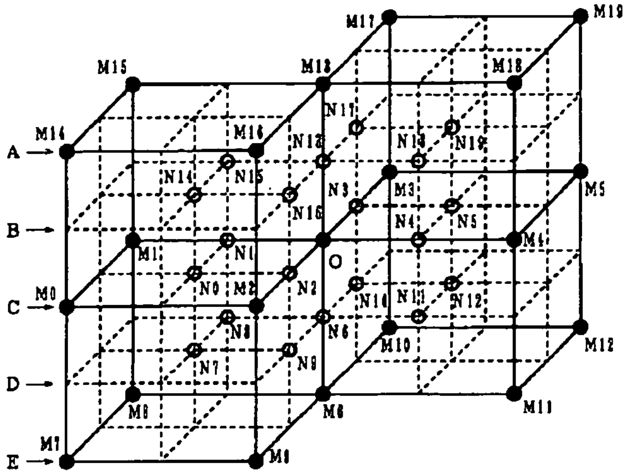
[Drawing 8]



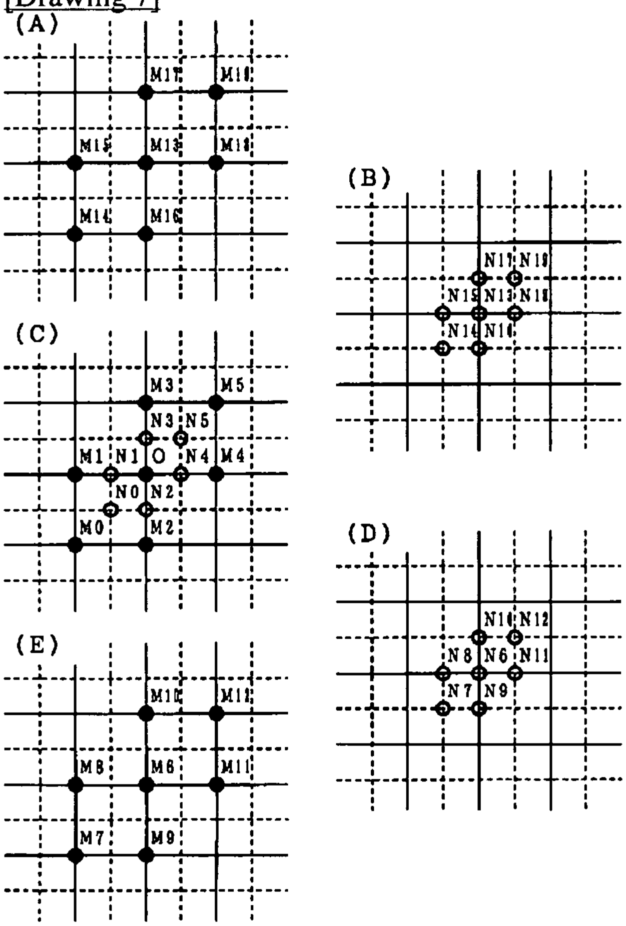
[Drawing 9]



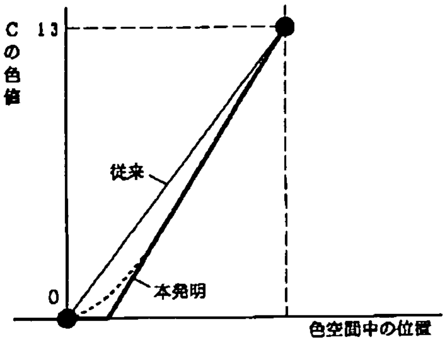
[Drawing 6]



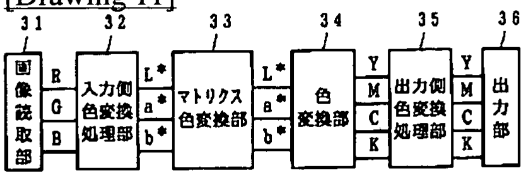
[Drawing 7]



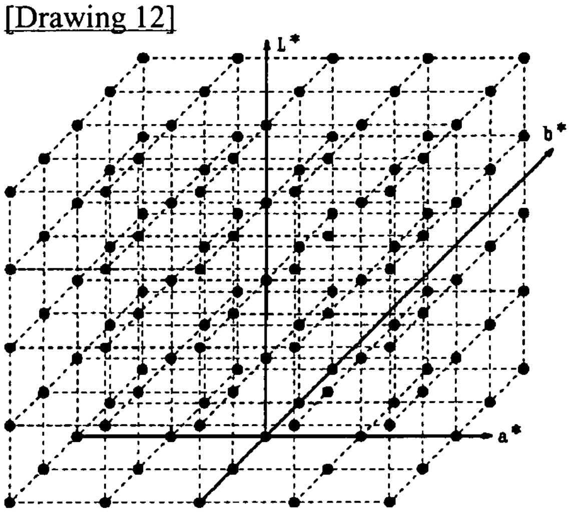
[Drawing 10]



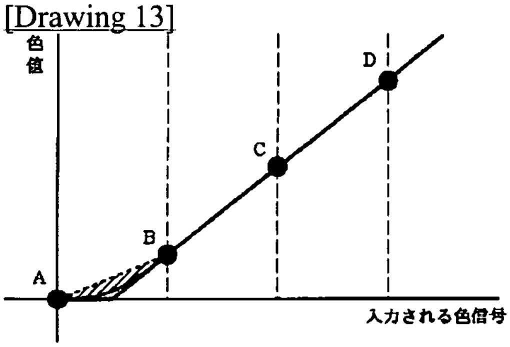
[Drawing 11]



[Drawing 12]



[Drawing 13]



[Translation done.]